Phytologia (May 1989) 66(3):199-220

NOTES ON SELECTED GENERA RELATED TO *CHORIZANTHE* (POLYGONACEAE: ERIOGONOIDEAE)

JAMES L. REVEAL

Department of Botany, University of Maryland, College Park, Maryland 20742-5815

ABSTRACT

In a revision of *Chorizanthe* prepared by Reveal and Hardham (1989b) several species were excluded. Three species were referred to new genera, *Aristocapsa*, *Dodecahema* and *Systenotheca*, all removed from the previously excluded genus *Centrostegia* which itself is now considered to be monospecific. The genus *Mucronea* with it two species and *Lastarriaea* with its three, along with the monospecific genus *Hollisteria*, have been maintained as distinct from *Chorizanthe*. Four of these excluded genera, *Muconea*, *Centrostegia*, *Hollisteria* and *Lastarriaea* are reviewed with the genera and its species characterized and representative specimens listed documenting their known distribution. *Lastarriaea ptilota*, endemic to the Desierto el Vizcaíno and the Cedros Island region of Baja California, México, is described as new. All of these genera are placed in the subtribe Hollisteriineae, which is defined to include those genera of the Eriogoneae having one to six flowers in an awned narrowly tubular involucre or subtended by bractlike involucral lobes.

KEY WORDS: Polygonaceae, taxonomy, *Mucronea*, *Centrostegia*, *Hollisteria*, *Lastarriaea*, California, México, Chile.

INTRODUCTION

In a recent review of the annual species of *Chorizanthe* (Reveal & Hardham 1989b), several species were excluded and referred to other genera. Three species generally included in *Chorizanthe* or *Centrostegia* were each placed in a monospecific genus: *Aristocapsa*, *Dodecahema* and *Systenotheca* (Reveal & Hardham 1989a). Four other species were removed from *Chorizanthe* as defined by some authors (Torrey & Gray 1870; Watson 1877; Jepson 1913, 1925; Abrams 1944; Munz 1959, 1974). These include *Chorizanthe californica* and *C. perfoliata* which we, like Goodman (1934) the last monographer of *Chorizanthe*, prefer to keep in *Mucronea* as defined by Bentham (1836, 1856) and followed by Hoover (1966). In addition, two other species often placed in *Chorizanthe* (Parry 1884, 1885; Goodman 1934; Munz 1959, 1974), *C. coriacea* of North America and the superfluous *C. lastarriaea* of South America, are returned to *Lastarriaea*, a genus that has long been considered to be distinct (Rémy 1851-1852; Torrey & Gray 1870; Watson 1877; Parry 1886; Jepson 1913, 1925; Abrams 1944; Hoover 1966; Wiggins 1980). Significantly, a new species is added to *Lastarriaea*, a central Baja California endemic currently known only from two collections. Two additional monospecific genera are also recognized, *Hollisteria* and *Centrostegia*. With the removal of three species previously placed in *Centrostegia* as noted above, *Centrostegia* now becomes monospecific but unlike the other segregates in North America whose species are essentially restricted to California and Baja California, *Centrostegia thurberi* is distributed over a wide

area of the American Southwest. The genus *Hollisteria* has uniformly been regarded as distinct from *Chorizanthe* or *Eriogonum* except indirectly by Jones (1908) who proposed a new species of *Chorizanthe* that proved to be based on specimens of *H. lanata.*, and by Roberty and Vautier (1964) who, in their bizarre review of the Polygonaceae, transferred *H. lanata* to *Eriogonum*. Shields and Reveal (1988) excluded *Hollisteria* from the *Chorizanthe* complex retaining it with *Eriogonum* where it had been traditionally placed (Curran 1885; Dammer 1892; Gross 1913a). That view is now rejected and *Hollisteria* is placed in the *Chorizanthe* complex in an isolated position.

The purpose of this paper is to present a series of descriptions and discussions of the four already established genera that are related to but distinct from *Chorizanthe*.

Taxonomy

The subf. Eriogonoideae was established by Meisner (1856) in the introduction to the Polygonaceae published in de Candolle's *Prodromus*. The name was used by numerous authors up to Melchior (1964) although, for some unknown reason, the taxon was reproposed by Roberty and Vautier (1964). In all instances, the taxon was circumscribed to include those genera of Polygonaceae that lacked a well defined ochrea. Dumort (1829) proposed the tribe Eriogoneae, placing it in the Chenopodiaceae; Bentham (1836) would later transfer the taxon to the Polygonaceae where it has remained essentially unchanged. Walpers (1852) elevated the group to the family rank, but the name has rarely been used. Torrey and Gray (1870) renamed the tribe Eueriogoneae. According to the *International Code of Botanical Nomenclature* (Greuter 1988), this last name is not only superfluous but such names are not permitted (Art. 21.3).

Within the subfamily, Torrey and Gray (1870) distinguished two tribes, Eriogoneae and Pterostegieae, and both are still recognized. The latter is restricted to *Pterostegia* and *Harfordia* (Reveal 1989a, b). Dammer (1892) had included these two genera, along with *Lastarriaea*, *Nemacaulis* and *Hollisteria*, in the subtribe Koenigiinae. Its type (Art. 22.4; Greuter 1988) is the genus *Koenigia* L., a taxon that is not now regarded to be a member of the subfamily (Roberty & Vautier 1964; Melchior 1964).

In his review of the Polygonaceae, Gross (1913a) recognized the subf. Eriogonoideae and divided it into two tribes, the Eriogoneae and the Hollisterieae. The latter was itself divided into two subtribes, Hollisteriinae and Harfordiinae. The latter consisted of *Pterostegia* and *Harfordia*, while the former included not only *Hollisteria* but *Gilmania* (as *Phyllogonum*) and *Nemacaulis* along with *Lastarriaea*. Gross defined the Eriogoneae to include *Eriogonum*, *Pterogonum* (a new genus he proposed), *Oxytheca*, *Centrostegia* and *Chorizanthe*.

Reveal and Howell (1976) recognized 13 genera in Eriogonoideae. With the publication of *Goodmania* (Reveal & Ertter 1977) the number increased to 14. In Shields and Reveal (1988), the general phylogenetic scheme called for both *Hollisteria* and *Nemacaulis* to be associated with *Eriogonum*, with the placement of *Hollisteria* the most problematic. Now it is proposed that *Hollisteria* be placed in the *Chorizanthe* complex.

As here defined, the tribe Eriogoneae is divided into two subtribes, Eriogonineae (Roberty & Vautier 1964) and the Hollisteriineae (Gross 1913a). The two taxa differ mainly in the number of flowers per involucre (mostly numerous in Eriogonineae versus 1-6 in the Hollisteriineae) but the two may also be differentiated by the general shape and construction of their involucres and by the presence or absence of uncinate or short involucral awns. A review of genera belonging to the Eriogonineae is presented elsewhere (Reveal 1989c).

Polygonaceae Juss. subtribe **Hollisteriineae** H. Gross, Bot. Jahrb. Syst. 49: 329. 1913. Polygonaceae tribe Hollisterieae H. Gross, Bot. Jahrb. Syst. 49: 239. 1913.– TYPE: *Hollisteria* S. Wats. according to Art. 22.4 of the ICBN.

Polygonaceae chort Chorizanthastreae Roberty & Vautier, Boissiera 10: 84. 1964.– TYPE: *Chorizanthe* R. Br. ex Benth. according to Art. 22.4 of the ICBN.

Plants annual or perennial herbs to subshrubs; *leaves* basal or cauline, mostly narrow, thinly to densely pubescent; *inflorescences* mostly cymose with the secondary branches typically suppressed; *peduncles* typically lacking or short and rather stout; *involucres* narrow and cylindrical or if broader then the tube cylindric and the teeth broad, divergent and thickish, the teeth typically armed with short, straight or more often uncinate awns, occasionally the involucre reduced to a series of awned involucral bracts; *flowers* 1-6 per involucre, usually short pedicellate, the tepals mostly narrow and thinly pubescent at least along the midrib; *achenes* narrow or globose with a straight or curved embryo; n = mostly 14, 17 or 19-24, 40.

Widespread in western North America from eastern Washington and Idaho south through California, Nevada and southern Utah to Arizona and northwestern México, and in southwestern South America in the arid regions of extreme southern Perú south to central Chile, with the greatest concentration in coastal and arid regions of California and northern Baja California.

The use of the name Hollisteriineae for the subtribe rather than one based on (and therefore typified by) *Chorizanthe* is unfortunate especially given the controversal positioning of *Hollisteria* within the *Chorizanthe* complex. Gross (1913a) initially failed to describe the subtribe (p. 239), but in his concluding remarks (p. 329) he provided a key to the higher taxa in Polygonaceae and there effectively published the name.

As here defined, the subtribe Hollisteriineae is composed of eight genera, the largest being *Chorizanthe* with some 50 species of annuals and perennials. This genus is the most widely distributed of the taxon being found throughout the range of the subtribe in North and South America (Reveal & Hardham 1989b). The majority of genera are endemic to California: *Aristocapsa*, *Dodecahema*, *Systenotheca*, *Mucronea* and *Hollisteria*. *Centrostegia* is found in southwestern North America from California east to southern Utah south into north- western México. The genus *Lastarriaea* is encountered along the coast and in the more arid inland regions of central and southern California southward to central Baja California, México, and then like *Chorizanthe*, it reappears again in the deserts of northern and central Chile. Except for *Mucronea* and *Lastarriaea*, all of these smaller genera are monospecific.

The vast majority of the species assigned to the subtribe are annuals; the ten or so Chilean perennial species of *Chorizanthe* being the only exception. The flowers are generally solitary in the involucre or at a node, but some may have two or three, with only one genus, *Aristocapsa*, having six flowers in the involucre. Flowers are in well defined involucres in all genera except *Hollisteria* and *Lastarriaea*. In these genera the involucre is reduced to a whorl of awned involucral bracts subtending the flower. The general shape of the involucre is long and slender with a generally cylindric shape. The involucral teeth are mostly short with short, straight or uncinate awns, but in several species the teeth are longer and stout with the divergent teeth thickened basally so that the teeth are often more pronounced than the tube. In such instances not all of the teeth may be awned for the smaller alternating three may be obscure and awnless. In a few instances, the number of lobes is truely three and in *Mucronea californica* it can be reduced to two. The majority of the involucral tubes are distinctly angled with six teeth. Major exceptions are the involucres of *Aristocapsa insigne*

and *Chorizanthe spinosa* where five involucral teeth and a smooth surface more typical of those seen in the Eriogonineae are encountered.

The flowers of *Lastarriaea* are coriaceous with each tepal bearing a small, terminal, uncinate awn similar to that found on involucres elsewhere in the subtribe. It and *Hollisteria* are the most advanced genera of the subtribe, but neither is all that closely related to the other. In *Centrostegia*, the five involucral lobes are fused so as to create a highly modified, 3-angled, prismatic tube.

Key to the Genera

A. Involucres distinctly tubular and well defined at least basally.
  B. Bracts opposite or whorled, not 3-lobed or parted; flowers 1 (2) in the involucre; plants annual or perennial; widespread in western North America and southwestern South America. ..... 1. *Chorizanthe*
  BB. Bracts alternate, 3-lobed or parted; flowers (1) 2-6 in the involucre; strictly annual.
    C. Involucres 2-4- or 6-lobed or -toothed; flowers 1-2 per involucre.
      D. Involucres not awned basally; California.
        E. Flowers pubescent, perfect; bracts conspicuous; involucral teeth unequal; Coast Ranges of central and southern California eastward onto the western edge of the Mojave Desert. ..... 2. *Mucronea*
        EE. Flowers glabrous but densely papillate, polygamo-dioecious with the upper one perfect and the lower one female; bracts small; involucral teeth equal; Santa Lucia Mountains of Monterey and San Luis Obispo cos. ..... 3. *Systenotheca*
      DD. Involucres awned basally; southwestern North America.
        E. Basal awns 3, curved on saccate basal lobes; terminal awns 5, straight; involucres strongly prismatic and 3-angled; flowers 2; California east to Utah and south to northwestern México. ..... 4. *Centrostegia*
        EE. Basal awns 6, uncinate on smooth basal lobes; terminal awns 6, uncinate; involucres strongly 6-angled; flowers 3; southwestern California. ..... 5. *Dodecahema*
    CC. Involucres 5-toothed; flowers 4-6 per involucre, pubescent; Coast Ranges of Monterey and San Luis Obispo cos. ..... 6. *Aristocapsa*
AA. Involucres reduced to a series of 3 (4) involucral bracts.
  B. Flowers bright yellow and densely tomentose with mucronate petaloid tepals; stamens 6-9; branches tomentose; central California. ..... 7. *Hollisteria*
  BB. Flowers light green to greenish-white, thinly pubescent with distinctly coriaceous awned tepals; stamens 3; branches glabrous or sparsely pubescent; widespread in central and southern California south to central Baja California, disjunct to Chile. ..... 8. *Lastarriaea*

Three of the above genera were described as new in this volume of *Phytologia* (Reveal & Hardham 1989a) and a revision of *Chorizanthe* is also presented Reveal & Hardham 1989b). Accordingly those genera are not treated again and the following remarks are restricted to *Mucronea*, *Centrostegia*, *Hollisteria* and *Lastarriaea*.

2. Mucronea Benth., Trans. Linn. Soc. London 17: 419. 1836. *Chorizanthe* R. Br. ex Benth. sect. *Mucronea* (Benth.) A. Gray, Proc. Boston Soc. Nat. Hist. 7: 148. 1859.–TYPE: *Mucronea californica* Benth.

Erect to spreading, sparsely glandular-pubescent annual herbs arising from a thin taproot; *leaves* basal, spatulate to obovate, sparsely hirsute or glabrous except for a ciliated margin and midvein, tapering to a slightly winged, ciliated or sparsely hirsute, sometimes indistinct petiole; *flowering stems* erect, slender to stoutish; *branches* dichotomously branched throughout; *inflorescences* cymose with the secondaries suppressed; *bracts* 3 (5), triangular to ovate or oblong, acute to obtuse, spreading to nearly erect, awn-tipped, hispid, hirsute or glandular

as well as ciliated along the margin, united nearly throughout and positioned to one side of the node or perfoliate and completely but unequally surrounding the node; *peduncles* lacking; *involucres* 1-3 at each node, cylindric, glandular-pubescent, (2) 3-4-lobed, the tube round to triangular or quadrangular, fused nearly throughout except for the glandular or slightly pubescent lobes, each lobe terminated by an awn, the awns of unequal length and divergent, the base of the tube slightly ventricose on the angles in some; *flowers* 1 (2) per involucre, white to pink, pubescent without along the midrib, on long non-stipitate glabrous pedicels, the tepals oblanceolate to oblong, entire or erose to fimbriate, united about a third of their length; *stamens* 6-9, mostly arranged in two whorls, the filaments glabrous, the anthers oblong; *achenes* brown to black, glabrous, the narrow to slightly globose base tapering to a long, slightly 3-angled beak, the embryo straight, in abundant endosperm; $n = 19$ (Hardham 1989).

A bispecific genus of California ranging from Monterey and Stanislaus cos. south to San Diego Co. eastward onto the northwestern edge of the Mojave Desert in Kern and Inyo cos. and in western San Bernardino and Riverside cos., from near sea level to 5000 (6000) ft elev; flowering from Mar-Jul (Aug).

Key to the Species

A. Bracts unilateral; involucres 1-3 per node, the lobes (2) 3 (4), 2.5-5 (7) mm long with the awns (0.5) 1-2.5 (3) mm long; flowers 1-2, the tepals entire; mostly coastal and in the coastal ranges from Monterey Co. south to San Diego Co. eastward to western San Bernardino and Riverside cos. ..... 1. *M. californica*

AA. Bracts orbicular-perfoliate; involucres 1 per node, the lobes 4, 3-5 (6) mm long with the awns (0.3) 0.5-1.2 mm long; flowers 1, the tepals entire or more often erose to fimbriate; coastal ranges and Central Valley from Stanislaus Co. south to the western edge of the Mojave Desert in Kern and perhaps Inyo cos. ..... 2. *M. perfoliata*

1. Mucronea californica Benth., Trans. Linn. Soc. London 17: 419. 1836. *Chorizanthe californica* (Benth.) A. Gray, Proc. Boston Soc. Nat. Hist. 7: 149. 1859.–TYPE: without location data, possibly near Monterey, Monterey Co., or near Santa Barbara, Santa Barbara Co., California, "1833," *Douglas s.n.* (holotype: K!; isotypes: CGE, GH, K, MO, OXF!).

Chorizanthe californica (Benth.) A. Gray var. *suksdorfii* Macbride, Contr. Gray Herb. 53: 6. 1918. *Mucronea californica* Benth. var. *suksdorfii* (Macbride) Goodman, Ann. Missouri Bot. Gard. 21: 91. 1934.–TYPE: Surf, Santa Barbara Co., California, 12 Jun 1913, *Suksdorf 146* (holotype: GH!; isotypes, NY, WTU!).

Plants (0.3) 0.5-3 (5) dm high and 1-6 (8) dm across; *leaves* with the blade (0.5) 1-5 cm long, (1) 2-8 (12) mm wide, narrowly spatulate to obovate, the petiole 0.5-3 cm long; *bracts* 3 (5), unilateral, triangular to ovate or oblong, 0.5-1 (2) cm long, acute to obtuse, spreading to nearly erect, united at least half its length, becoming acerose only at the terminal nodes and then linear to linear-lanceolate, mostly hirsute or glandular at least on the lower surface as well as ciliated along the margin, sometimes glabrous on the upper surface, each lobed tipped with an awn 1-2.5 (3) mm long; *involucres* 1-3 at each node, cylindric, 2.5-5 (7) mm long, glandular-pubescent and occasionally hirsute, the tube round to triangular, obscurely ribbed, the segments united about three-quarters of their length with the (2) 3 (4) free terminal lobes spreading to strongly divergent, glandular or slightly hirsute, bearing divergent awns of unequal lengths, (0.5) 1-2.5 (3) mm long, the tube not ventricose basally; *flowers* 1 (2), 1.5-2.5 (3) mm long, white to pink with reddish or greenish midribs, pubescent without along the midribs or at least at the base, the tepals oblong, entire, united about a third of

their length; *stamens* 9, the filaments 1-2 (2.5) mm long, glabrous but minutely papillose, the anthers 0.5-0.7 mm long, pink to red; *achenes* 2-3 mm long; $n = 19$ (Hardham 1989).

Locally common mainly in sandy places along the Pacific Coast from San Luis Obispo Co. south to San Diego Co. and inland in the southern Coast and Transverse ranges from Monterey Co. to Los Angeles, extreme western San Bernardino and northwestern Riverside cos., California, from sea level to 3200 (4500) ft elev; flowering from (Mar) Apr-Jul (Aug).

Representative Specimens. – UNITED STATES. CALIFORNIA: Kern Co.: 0.2 mi N of the confluence of Cedar and Lumreau creeks on the Farnsworth Ranch near Glennville, 5 Jul 1978, *Farnsworth s.n.* (CAS). Los Angeles Co.: Playa del Rey, 10 Jun 1902, *Abrams 2507* (BM, DS, E, F, G, GH, K, MO, NEB, NMC, NY, ORE, PH, POM, US, Z); Cajon Pass, San Gabriel Mountains, 16 May 1931, *Epling et al. s.n.* (BM, BR, DS, K, LA, MARY, MICH, MIN, ND, NO, NY, RSA, UCR, WTU); Arcadia, 1901-1905, *Grant 173* (E, F, G, GH, ILL, MIN, MO, NMC, PH, RM, SMU, UC, US, W, WIS); Pasadena, 3 May 1882, *M.E. Jones 3221* (BM, BR, CAS, DAO, ILL, LE, MO, MSC, NY, POM, RM, UC, US, UTC); Point Dume, 4 Jun 1959, *Raven & Thompson 14318* (CAS, GH, RSA); San Gabriel Wash at Arrow Highway, 4 Jun 1932, *Wheeler 798* (F, GH, ILL, MIN, NY, OKL, UC, US, Z). Monterey Co.: Bald Mountain at SE edge of Fort Hunter Liggett Army Base, along the Bryson-Hesperia Road 4.3 km NW of Sapaque Road, 11 Jul 1978, *Broome et al. 2265* (BRY, CAS, MARY, RSA, WIS); Lowes Canyon, 15 mi NE of San Miguel, 15 May 1958, *Hardham 3334* (CAS, DAO, RSA); near Pleyto, 29 May 1958, *Hardham 3498* (CAS, RSA, SBBG); 10 mi above Carmel on Carmel River, 23 Jun 1923, *Mason 544* (DS, GH, NY, UC). Riverside Co.: Wilder's Canyon, near Riverside, 15 May 1904, *Wilder s.n.* (POM). San Bernardino Co.: San Bernardino, May 1913, *Jepson 5522* (JEPS, RM, WIS); San Bernardino, Apr 1876, *Lemmon s.n.* (BM, F, G, JEPS, NEB, OKL); near San Bernardino, May 1894, *Parish 2822* (ILL, MICH, MIN, NY, POM, VT, WIS); Colton, 30 May 1882, *Pringle s.n.* (CAN, F, G, GH, K, LE, MIN, MPU, NY, PENN, PH, US, VT). San Diego Co.: Ocean Beach, 27 May 1902, *Brandegee 1603* (CAN, CAS, E, G, GH, K, L, LE, MICH, MO, MSC, NY, POM, UC, US, WS); Coronado, 7 May 1891, *Dunn s.n.* (B, DS, G, MIN, UC, US); Torrey Pines Park, near La Jolla, 30 Apr 1947, *Munz & Everett 11706* (NY, RSA, WTU). San Luis Obispo Co.: 2.3 mi SE of Genesco School on the road to Creston, 23 May 1955, *Ferris 12794* (DS, NY, RSA, WS, WTU); North Traffic Way, Atascadero, 31 May 1958, *Hardham 3465* (CAS, DAO, SBBG); summit at head of Carpenter Canyon, N of Arroyo Grande, 23 Jun 1946, *Hoover 6188* (CAS, OBI, OKL, UC); Yaro Creek, near junction with Toro Creek, 24 May 1947, *Hoover 7203* (CAS, DAO, OBI, RSA); 6 mi N of Guadalupe, 20 Jul 1933, *Purer 5088* (DS, GH, POM, SD); along California Highway 58, 0.5 mi W of Shell Creek Road, 26 May 1988, *Reveal 6911* (BRY, CAS, MARY, MO, NY, OSC, RM, RSA, UTC, WIS); along Los Osos Valley Road, 0.2 mi NW of the entrance to Montaña de Oro State Park, San Luis Range, 18 Jun 1987, *Reveal et al. 6480* (ARIZ, BM, BRY, CAS, MARY, MICH, MO, NY, RM, RSA, TCD, US, WIS); Nipomo Mesa N of Union Oil Refinery and S of the Stauffer Chemical Plant, just off California Highway 1, 7 mi W of Nipomo, 18 Jun 1987, *Reveal et al. 6485* (ARIZ, CAS, MARY, MO, NY, RSA, WIS); Jack Lake, 3 mi S of Oceano, 7 Jun 1968, *Thorne 37782* (BRY, NY, RSA, UCR). Santa Barbara Co.: 0.5 mi NW of La Purisima Mission, near Lompoc, 15 Jul 1958, *Balls 23538* (BM, CAS, E, RSA, UC, WTU); Burton Mesa, N of Lompoc, 15 Jun 1960, *E.R. Blakley 3480* (CAS, RSA, SBBG, UCSB); Surf, May 1902, *Elmer 3837* (BKL, CAS, COLO, DS, E, F, G, GH, K, MICH, MIN, MO, NY, POM, SMU, UC, US, VT, WIS, Z); 5 mi S of Surf, 14 Apr 1929, *Ferris 7560* (DS, F, GH, POM, UC); Purisima Hills, Harris Grade, along California Highway 1, 1.2 mi N of Burton Hill Mesa Road, 22 Jun 1987, *Reveal & Broome 6524* (ARIZ, CAS, MARY, MO, NY, RSA, TCD, WIS); 20 mi E of Santa Maria on California Highway 166 along the Cuyama River at N end of Sierra Madre Mountains, 6 Jun 1954, *Sharsmith 4418a* (ARIZ, BR, DAO, ID, IDS, ILL, MIN, OKL, RM, RSA, SMU, UC, US, UTC, WIS, WTU); Graciosa Ridge, SE of Orcutt, W of Mt. Solomon, 13 Jun 1973, *Tilforth & Dourley 841* (MICH, NY, RSA, SD, UC). Ventura Co.: Upper Cuyama River, on the road to Frazier Mountain, 30 May 1950, *Kappler 2067* (LA). A total of 300 collections were examined.

It is not easy to exactly determine where Douglas made his type collection of the genus *Mucronea* (Latin *mucronis*, sharp point, alluding to the awn-tipped involucral lobes). It is suggested that it likely came from near Monterey in Monterey Co., California, and this is meant to imply the area along the Carmel River to the south and east. The plants, nonetheless, are not so distinctive as to exclude the possibility that Douglas found them near Santa Barbara where he visited in May of 1832. All of Douglas' eriogonoid types belonging to the subtribe Hollisteriineae are dated 1833, but most were likely gathered in California in 1831 or 1832. Douglas was in California on his most extended visit from January 1831 until August of 1832, a total of nineteen months by his own estimation (McKelvey 1955). He took his

California collections with him when he sailed for the Hawaiian (Sandwich) Islands; it was from here the lot was sent to England arriving there in 1833 which accounts for the date.

The large coastal expression found from Surf, Santa Barbara Co., to the Los Angeles area has been distinguished as the var. *suksdorfii*. It is nothing more than a seasonal variation that may be seen when sufficient moisture has made it possible for individual plants to reach considerable size.

Mucronea californica was once fairly widely distributed in southern California, but given the extensive urbanization of the Los Angeles and San Diego areas, the species is now relatively rare in the more southerly counties. In San Luis Obispo and Santa Barbara cos., however, the species is common in deep sandy soil and might even be weedy. In general, if the habitat is badly disturbed the species will gradually disappear. Off-road vehicular activities on some coastal dunes have certainly resulted in the loss of local populations.

On the eastern foothills of the coast ranges, *Mucronea californica* can be found growing near or with *M. perfoliata* on the distributional or ecological edge of both species. There has been no indication of hybridization or intergradation of the two although occasionally old and fragmentary material can be difficult to assign to a species.

2. Mucronea perfoliata (A. Gray) A. Heller, Muhlenburgia 2: 23. 1905. *Chorizanthe perfoliata* A. Gray, Proc. Boston Soc. Nat. Hist. 7: 148. 1859.–TYPE: near Fort Tejon, Kern Co., California, 1857-1858, *Xantus 108* (holotype: GH!; isotypes: DS, K, NY, PH TCD, US!).
Mucronea perfoliata (A. Gray) A. Heller var. *opaca* Hoover, Leafl. W. Bot. 10: 343. 1966.–TYPE: Navajo Creek, E side of the La Panza Range, San Luis Obispo Co., California, 31 May 1947, *Hoover 7248* (holotype: CAS!; isotypes, OBI, OKL, SD, UTC!).

Plants (0.2) 0.3-2 (3) dm high and 0.5-5 dm across; *leaves* with the blade (1) 2-5 cm long, (2) 3-12 (20) mm wide, spatulate, the petiole inconspicuous; *bracts* 3, perfoliate, orbicular to triangular, 0.5-1 (2) cm long, acute to obtuse, spreading to nearly erect, united nearly their entire length, becoming exceedingly one sided and weakly perfoliate apically, glabrous or sparsely hirsute and often glandular, ciliated along the margin, each lobe tipped with an awn 0.3-1.2 (1.5) mm long; *involucres* solitary, cylindric, 3-5 (6) mm long, glandular-pubescent and usually hirsute especially along the margins of the angles, the tube 4-angled, often curved, distinctly ribbed and usually corrugate, the segments united about three-quarters of their length with the 4 free terminal lobes spreading to strongly divergent, glandular or slightly hirsute, the awns straight, (0.3) 0.5-1.2 mm long, the tube often strongly ventricose basally; *flowers* 1, 1.5-3 (3.5) mm long, white to pink with reddish or greenish midribs, pubescent without along the midribs, the tepals narrowly oblanceolate, entire or more commonly erose or fimbriate apically, infrequently bilobed, united about a third of their length; *stamens* 9, the filaments 1-2.5 (3) mm long, glabrous but minutely papillose, the anthers 0.5-0.8 (0.9) mm long, pink to red; *achenes* 2-3 mm long; $n = 19$ (20) (Hardham 1989).

Locally common in sandy to gravelly places in the Coast and Transverse ranges from Stanislaus Co. south to Ventura Co. and in the San Joaquin Valley from Kings Co. southward to the Tehachapi Mountains and the northwestern edge of the Mojave Desert Kern and perhaps Inyo cos., California, from 600-5000 (6000) ft elev; flowering from Mar-Jun (Jul).

Representative Specimens.–UNITED STATES. CALIFORNIA: Fresno Co.: S of Curry Mountain on the road from Coalinga to Parkfield, 13 Jun 1938, *Eastwood & Howell 5844* (CAS, ISC, PENN, UC, WTU). Inyo Co.: Hunter Mountain, Panamint Mountains, Aug 1964, *B.D. Rogers s.n.* (HSC). Kern Co.: Tehachapi, 1884, *Curran s.n.* (F, UC); Maricopa Hills, 15 May 1913, *Eastwood 3268* (BM, CAS, GH, K, US); near Taft, 12 Apr 1935, *Esau s.n.* (CAS, DAV); Keene, 22 May 1903, *M.E. Jones s.n.* (CAS, POM, US); 0.6 mi E of California City Boulevard, 3.5

mi SE of California City, 13 Apr 1982, *Luckow & Riggins 783-1* (OBI); 1.4 mi N of McKittrick along California Highway 33, 24 May 1962, *Tavares 1249* (CM, ISC, MSC, OBI, POM, RM, TEX, UC); Breckenridge Mountain, 8 Jun 1967, *Vasek s.n.* (UCR). Kings Co.: Kettleman Hills, near Avenal, 1 May 1938, *Hoover 3320* (DS, K, LL, MICH, NY, UC, US, UTC). Los Angeles Co.: near Fort Tejon Road, 0.5 mi W of Longview Road, 3.5 mi S of Pearblossom, 19 May 1983, *Ballmer s.n.* (TEX, UCR); W side of Bob's Gap Road, N of Bob's Gap, 11 May 1973, *DeBuhr 1031* (ISC); 4 mi E of Palmdale, Antelope Valley, 8 May 1926, *Peirson 6726* (NO, RSA); along Mt. Emma Road, 0.5 mi E of Little Rock Creek, 11 May 1973, *Thorne 43549* (MICH, NY, RSA). Merced Co.: Ortigalita Canyon, 2 mi NE of Ortigalita Peak, 3 May 1940, *Mason 12262* (UC). Monterey Co.: Hope Bagby Hidden Valley Ranch, 28 May 1965, *Hardham 12631b* (CAS). San Benito Co.: 4.6 mi S of Panoche Road on Idria Road, 20 Apr 1958, *Hesse 2454* (UC); San Carlos Creek, San Carlos Range, 13 May 1907, *Jepson 2737* (JEPS); 17.6 mi from New Idria on road to Panoche, 6 May 1956, *Raven et al. 9229* (CAS, NY). San Bernardino Co.: Kramer, Jun 1910, *K. Brandegee s.n.* (UC); Mojave River, 23 May 1876, *Palmer 468* (B, GH, LE, NY, US); Mojave Desert, May 1882, *Parish & Parish 1515* (BM, DS, F, LE, RSA, WU); hills bordering the Mojave Desert, 25 May 1882, *Pringle s.n.* (CAN, E, F, G, LE, MPU, NY, PENN, PH, US, VT, WU). San Luis Obispo Co.: Black Mountain, 21 May 1960, *Hardham 5848* (CAS, RSA, SBBG); Pilitas Creek, 24 May 1947, *Hoover 7191* (CAS, NY, OBI, OKL); Santa Margarita, 1889, *Parry s.n.* (ISC, MO, NY); along California Highway 58, 0.6 mi E of the San Juan River bridge, 25 Jun 1978, *Reveal 4763* (CAS, GH, MARY, MO, NY, OKL, RSA, TEX); at the junction of the roads E of Navajo Campground, 17 Jun 1987, *Reveal & Broome 6477* (ARIZ, CAS, MARY, MICH, MO, NY, RM, RSA, US, WIS); summit of Palo Prieta Creek, 7 mi S of Cholame, 7 Jun 1954, *Twisselmann 1339* (CAS). Santa Barbara Co.: White Ledge, Hurricane Deck, San Rafael Mountains, 8 Jun 1969, *E.R. Blakley 6951* (SBBG); 8 mi N of Manzana Campground, San Rafael Mountains, 29 May 1959, *Hardham 4677* (CAS, DAO); along the Ballinger Canyon Road, 2.3 mi E of California Highway 33, 24 May 1988, *Reveal 6895* (BM, BRY, CAS, G, MARY, MO, NY, OSC, RM, RSA, US, UTC, WIS); 3 mi S of California Highway 166 on California Highway 33, 8 May 1977, *R.E. Steele 42* (UCR, UCSB). Stanislaus Co.: 2-4 mi above Camp 74, Puerto Cañon, 11 Jun 1862, *Brewer 1261* (CAS, GH, K, MO, UC, US, WS); Del Puerto Canyon, 17 Apr 1971, *Thiers 27168* (SFSU). Ventura Co.: Ozena Valley, 4.5 mi E of U.S. Highway 399 on the Lockwood Valley Road, 19 Apr 1962, *Breedlove 2429* (DS, UCSB); along California Highway 33, 3 mi below Pine Mountain summit, 17 Jun 1967, *Chandler 3545* (SBBG); Quatal Canyon, 5.3 mi E of California Highway 399, 7 Jul 1963, *Piehl 63651* (SBBG); Dry Canyon, San Emigdio Range, 14 Jun 1956, *Twisselmann 2992* (CAS, DS). A total of 194 collections examined.

The var. *opaca* was applied by Hoover (1966) to those populations of *Mucronea perfoliata* found in the chaparral of the inner Coast Range in San Luis Obispo Co., California. The bracts, in this expression, are thinly hirsute while those of the plants more to the east and in more arid situations tend to be glabrous. While this is generally true, the Xantus type of the species has hirsute bracts, and as this feature is not a consistent one, no taxonomic differentiation is proposed.

Of perhaps greater interest is the variation in the tepal fimbriation and size. There are two distinct size classes in *Mucronea perfoliata*, with one bearing much larger flowers than the other. In the field the two can be found in close proximity (compare the Ballinger Canyon, Santa Barbara Co. populations, *Reveal 6895* and *6901*) and the difference is obvious. Not only are the flowers much larger but the extent of segmentation of the upper tepal is greater. In some populations the tepals are entire and therefore similar to those found in *M. californica*. No geographic or ecological setting is associated with any one type of flower or tepal shape.

Hardham (1989) found at least one population of *Mucronea perfoliata* with a chromosome number of $n = 20$. Given the consistency of $n = 19$ she otherwise reported for the species, and a similar number in *M. californica*, and other related genera such as *Centrostegia* and very likely *Systenotheca*, I am reserving judgment on accepting the odd count as common.

The questionable inclusion of Inyo Co. in the distribution of *Mucronea perfoliata* is based on a collection made at Hunter Mountain in the Panamint Range (see above). This is well outside the expected distribution of the species and until it is confirmed, the range extension must be regarded with some suspicion.

4. Centrostegia A. Gray ex Benth. in A. DC., Prodr. 14: 27. 1856. *Chorizanthe* sect. *Centrostegia* (A. Gray ex Benth. in A. DC.) C. Parry, Proc. Davenport Acad. Nat. Sci. 4: 50. 1884.–TYPE: *Centrostegia thurberi* A. Gray ex Benth. in A. DC.

Erect to spreading, sparsely glandular annual herbs arising from a thin taproot; *leaves* basal, oblong to broadly spatulate, glabrous, tapering to a glabrous indistinctly winged petiole; *flowering stems* erect, slender; *branches* dichotomously branched throughout; *inflorescences* cymose, often with the secondaries suppressed; *bracts* mostly 3, linear to linear-lanceolate, spreading, awn-tipped, glabrous except for ciliated marginal hairs, united less than a quarter of their length and positioned to one side of the node; *peduncles* lacking; *involucres* solitary, prismatic and strongly 5-lobed and 3-angled, glabrous, the lobes variously united with each terminated by a short awn, the base enlarged with 3 saccate, awn-tipped spurs; *flowers* 2 per involucre, white to pink, pubescent without at least basally, on long, non-stipitate glabrous pedicels, the tepals oblanceolate and apically bilobed, united only at the very base; *stamens* 9, mostly arranged in two whorls, the filaments glabrous, the anthers oblong; *achenes* brown, glabrous, the globose base tapering to a long, 3-angled beak, the embryo curved, in abundant endosperm; $n = 19$ (Hardham 1989).

A widespread monospecific genus of arid regions in southern and eastern California eastward across western and southern Nevada to southern Utah, northern and western Arizona, and southward into northwestern Sonora and northern Baja California Norte, México, from 1250-7700 ft elev; flowering from (Mar) Apr-Jun (Jul).

The genus *Centrostegia* (Greek *kentron*, spur, and *stegion*, roof, alluding to the arched saccate spurs of the involucre) is now considered to be monospecific. Torrey and Gray (1870) were the first to add to the genus, proposing *C. leptoceras*, while Heller (1910) would add *Chorizanthe insignis* after Watson (1877) had reduced *Centrostegia* to *Chorizanthe*. Goodman (1934) transferred *C. insignis* to *Oxytheca* while at the same time he moved *Chorizanthe vortriedei* to *Centrostegia*.

The continued association of *Centrostegia leptoceras* with *C. thurberi*, the type of the genus, can no longer be maintained and the former is now referred to a new genus, *Dodecahema* (Reveal & Hardham 1989a). Both basal and terminal awns are found in *Centrostegia* and *Dodecahema*. The spinelike awns on the involucre of *D. leptoceras* represents a fusion of two sets of bracts. The innermost formed the erect, 6-lobed involucral body with each segment free or at best only slightly fused by a thin membrane. The basal set of bracts appear to represent an additional whorl. The six awns of this outermost whorl are long, uncinate and alternate with the six inner terminal ones. The basal ones arise from a thickened rim at the base of involucral tube, but this is not in any way an enlargement or inflation.

The spurlike awns found at the base of the involucre in *Centrostegia thurberi*, as well as the involucre itself, had an origin independent of that found in any other genus of the Hollisteriineae. The five lobes of the involucres are fused nearly throughout their entire length forming a 3-angled body. Two of the resulting keeled segments of the involucre are constructed of two wholly fused involucral lobes so that the apex of each of the resultant keeled segments is itself slightly lobed with each of the two fused lobes terminated by a short awn. The remaining keeled segment of the involucral body, specifically the one opposite its point of attachment at the node, is constructed of only a single lobe. This one may be readily identified as it is terminated by a single awn.

The enlarged saccate base of the involucre ends in a spurlike projection that is terminated by a short awn. Its origin is not of a second whorl of bracts but rather of a basal expansion of the involucral lobes themselves. Thus, the involucre of each genus is individually unique and of totally different origins. The distinctly saccate base of the involucre of *Centrostegia thurberi* is hinted at in *Mucronea* and in scattered species of *Chorizanthe* where ventricose involucral tubes may be seen, but none is as well developed as in *C. thurberi*.

1. **Centrostegia thurberi** A. Gray ex Benth. in A. DC., Prodr. 14: 27. 1856. *Chorizanthe thurberi* (A. Gray ex Benth. in A. DC.) S. Wats., Proc. Amer. Acad. Sci. Arts 12: 269. 1877.–TYPE: hillsides near San Felipe, Imperial Co., California, May 1852, *Thurber 630* (holotype: GH!; isotypes: F, K, NY!).

   Chorizanthe thurberi (A. Gray ex Benth. in A. DC.) S. Wats. var. *cryptantha* Curran, Bull. Calif. Acad. Sci. 1: 275. 1886. *Centrostegia cryptantha* (Curran) Goodding, Bot. Gaz. 37: 53. 1904.–TYPE: Lancaster Station, Los Angeles Co., California, Jul 1884, *Curran s.n.* (holotype: CAS!; isotypes, ISC, NY!).

   Chorizanthe thurberi (A. Gray ex Benth. in A. DC.) S. Wats. var. *macrotheca* J.T. Howell, Leafl. W. Bot. 3: 205. 1943. *Centrostegia thurberi* A. Gray ex Benth. in A. DC. var. *macrotheca* (J.T. Howell) Goodman, Leafl. W. Bot. 8: 128. 1957.–TYPE: Alcalde, Fresno Co., California, 9 May 1893, *Eastwood s.n.* (holotype: CAS!).

Plants 0.3-2 (3) dm high and (0.6) 1-4 (5) dm across; *leaves* with the blade (0.5) 1-3.5 (4) cm long, 3-8 (10) mm wide, oblong to broadly spatulate, the petiole indistinct; *bracts* 3 (4), unilateral, (1) 2-6 (10) mm long, linear to linear-lanceolate, mostly spreading, united less than a quarter of its length, commonly acerose, glabrous except for the ciliated margins, awn-tipped, the awns 1-2 mm long; *involucres* solitary, prismatic and strongly 3-angled, (2) 3-6 (8) mm long, glabrous, the 5 lobes fused along their margins more than four-fifths of their length into three flattened keeled segments, two of the three keeled segments formed by the complete fusion of two lobes with the third keeled segment composed of a single lobe, each lobe terminated by a short, erect awn 0.3-1 mm long, the base of the tube enlarged at each of the three keeled segments into a saccate, awned horn, the straight awns 0.2-2 mm long; *flowers* 2, 2-3 (3.5) mm long, white to pink with reddish or greenish midribs, pubescent without at the base with short thin hairs, on glabrous pedicels up to 2.5 mm long, the tepals oblanceolate, apically bilobed, united only at the very base; *stamens* 9, the outer three on filaments 2-3 mm long with the anthers soon deciduous, the inner six on filaments mostly 1-2 mm long with the anthers persistent and maturing as a unit after the outer three, the anthers 0.4-0.5 mm long, pink to red; *achenes* 2-2.5 mm long; $n = 19$ (Hardham 1989).

Widespread and common on sandy to gravelly soils in arid regions mainly on the Mojave and Sonoran deserts of eastern and southern California and in the mountains and foothills bordering the San Joaquin Valley from San Benito and Fresno cos. southward and from Mono Co. eastward into western and southern Nevada from Washoe Co. to Clark and Lincoln cos. and across the southern tier of counties in Utah into northern and western Arizona south to northwestern Sonora and northern Baja California Norte, México, from 1250-7700 ft elev; flowering from (Mar) Apr-Jun (Jul).

Representative Specimens.–MÉXICO. BAJA CALIFORNIA NORTE: NE base of Cerro Chichi de la India, Sierra Juárez, 31 May 1982, *Moran 30890* (ARIZ, ASU, CAS, COLO, DAV, ENSB, MARY, MICH, RSA, SBBG, SD, TEX). SONORA: without location data, without date, *Parry et al. 1170* (LE). UNITED STATES. ARIZONA: Coconino Co.: N end of Coyote Valley, 0.3 mi S of the Utah line, 14 May 1978, *Brown & Parfitt 552* (ASU, BRY); 25 mi SE of Page along the Page-Kaibito Highway, 28 May 1973, *Hevly s.n.* (CM, NY). Gila Co.: W side of San Carlos River near its mouth, 4 Apr 1935, *Maguire et al. 10477* (ARIZ, BRY, NY, UTC, WTU); Apache Trail between

Roosevelt Lake and Miami, 6 May 1935, *Nelson & Nelson 1797* (BRY, G, GH, K, MICH, MO, NY, OKL, PH, RM, SMU, UC, US, UTC, WTU). Graham Co.: near Fort Thomas, 17 Apr 1940, *Peebles 14581* (ARIZ). Maricopa Co.: W Sycamore Creek, Tonto Basin, 5 May 1931, *G.J. Harrison 7799* (ARIZ, US); 12 mi E of Fish Creek, along Arizona Highway 88, 19 May 1962, *Lehto 824* (ASU, OBI); 3 mi W of Wickenburg, 20 Apr 1932, *Peebles 8480* (ARIZ, US). Mohave Co.: 8 mi S of Arizona Highway 389, 4 mi W of Fredonia, 19 May 1972, *Atwood & Higgins 3925* (BRY, HSC, US, UT); E entrance to Hualape Mountain Park, 6 Apr 1972, *Brown et al. 689* (ARIZ, ASU, ENCB, ID, OBI); Peacock Mountains, 3.5 air mi SE of Hackberry, 7 May 1973, *Holmgren & Holmgren 7140* (ASU, BRY, ID, MONTU, NY, UTC, WTU); Hackberry, 23 May 1884, *M.E. Jones 4712* (ARIZ, BM, BR, DS, F, G, MIN, MSC, NY, POM, RM, US, UTC); W of Kingman, 14 Apr 1937, *Maguire s.n.* (BRY, DAO, NY, UTC, WTU); Moseby's Redrock Spring, E side of the Virgin Mountains, 6 Jun 1941, *Munz 16770* (POM, WTU). Pima Co.: along Pontatoc Road near de Grazia's Mission, N of Tucson, 3 Apr 1958, *Matsuda s.n.* (ARIZ). Pinal Co.: 46 mi N of Tucson, 26 Mar 1934, *Maguire 10242* (NY, UTC). Yavapai Co.: hills on the E side of Black Mountains, W of U.S. Highway 93, 6 May 1979, *P.C. Fischer 6417* (ARIZ, ASU); 1.6 mi SE of Santa Maria River, U.S. Highway 93, Joshua Tree Parkway, 3 May 1969, *Pinkava & Lehto 6188* (ASU, SD). CALIFORNIA: Fresno Co.: Alcalde, May 1891, *Brandegee s.n.* (UC); W of Coalinga, 13 Jun 1910, *Condit 47* (UC). Imperial Co.: San Felipe, May 1855, *Antisell s.n.* (NY). Inyo Co.: Darwin Mesa, 20 May 1891, *Coville & Funston 798* (DS, K, NY, US); 3 mi W of Laws, 8 May 1906, *Heller 8206* (BKL, DS, E, F, G, GH, ISC, L, MO, NY, PH, UC, US, UTC, WU); E of Wyman Creek, 3.1 mi NE of Deep Springs College, 27 Apr 1986, *Morefield & McCarty 3524* (BRY, MARY, MO, RSA, TEX, UCR); Argus Mountains, Apr-Sep 1897, *Purpus 5353* (E, GH, K, MO, US, Z); 2 mi NE of Willow Springs, Last Chance Mountains, 18 Jun 1955, *Roos 6422* (DS, RM, RSA, SD, UC, UCR, US). Kern Co.: 1 mi SW of Bodfish on road to Havilah, Piute Mountains, 14 Jul 1962, *Breedlove 3828* (CAS, DS, RSA, SMU); Kern River Valley, 23 Jun 1891, *Coville & Funston 1045* (CAS, DS, K, NY, US); Mojave, 11 May 1917, *M.E. Jones s.n.* (CAS, DS, MIN, PH, UC, US); Erskine Creek, Apr-Sep 1897, *Purpus 5300* (E, GH, K, MO, US, Z); 1.2 mi S of Eugene Grade, S of Pine Springs below trail to Mine Spring, Greenhorn Mountains, 26 Jul 1962, *C.N. Smith 1115* (JEPS, RM, UTC, WTU); Temblor Range, Cedar Canyon, 0.5 mi above the forks, 5 Jul 1971, *Twisselmann 17816* (CAS, DAO, OSC, RSA). Kings Co.: Kettleman Hills near Avenal, 1 May 1938, *Hoover 3314* (NY, UC, US). Los Angeles Co.: near Lancaster, 23 May 1933, *Duran 3417* (BKL, BM, BR, BRY, CAN, DAV, DS, F, G, GH, ISC, K, LE, MARY, MIN, MO, MSC, NO, NY, RM, RSA, UC, US, UTC, WIS, WS, WTU); Acton, Jun 1902, *Elmer 3679* (BKL, CAS, COLO, DS, E, F, G, GH, K, MICH, MIN, NY, POM, US, VT, WIS, Z); 0.2 mi above North Fork Camp, North Fork of Tujunga Creek, San Gabriel Mountains, 12 Jun 1932, *Ewan 7368* (MIN, NO, OKL); Arraster Creek, San Gabriel Mountains, 10 May 1919, *Peirson 28* (CAS, DS, NO, RSA); Portal Ridge N of Elizabeth Lake, 2.1 mi E of Lake Hughes, 16 May 1988, *Reveal 6776* (BM, BRY, CAS, G, MARY, MEXU, MO, NY, OSC, RM, RSA, US, UTC, WIS); Bob's Gap, 2 mi ENE of Valyermo, San Gabriel Mountains, 24 May 1973, *Tilforth & Dourley 824* (MICH, NY, RSA, UC). Merced Co.: Piedra Azul Canyon, 4 May 1940, *Hoover 4373* (DS, K, NY, UC, US, UTC). Mono Co.: 1.5 mi below mouth of Pellisier Creek near road, 1.5 mi SW of Mt. View and Proctor Mine, White Mountains, 19 Apr 1986, *Morefield & McCarty 3457* (BRY, MARY, MO, RSA, TEX, UCR). Riverside Co.: N base of Eagle Mountains, 15 May 1941, *Alexander & Kellogg 2176* (DS, GH, ISC, POM, UC, UTC, WS, WTU); 15 mi SW of Twentynine Palms, 2.5 mi N of Salton View, Joshua Tree National Monument, 29 May 1971, *Henrickson 5573* (ASU, CHSC, HSC, UNLV); Kenworthy, San Jacinto Mountains, 21 May 1922, *Munz & Johnston 5508* (POM). San Benito Co.: Griswold Hills at junction with Griswold Creek and Vallecitos Road, 10 May 1936, *Lyon 796* (CAS, UC). San Bernardino Co.: S of Victorville, 5 Jun 1941, *Alexander & Kellogg 2301* (GH, MO, NY, RM, UC, UTC, WS); Horsethief Canyon, 15 May 1935, *Clokey & Anderson 6598* (BKL, IDS, ILL, NY, POM, RENO, UC, WIS, WS, WTU); 5 mi E of Cima, 4 May 1935, *Munz 13948* (DS, F, POM, UC, UTC, WTU); Mojave Desert, May 1881, *Parish & Parish 895* (B, BR, DS, F, G, ISC, LE, MIN, PH, US, WS, WU); Mojave Desert, 24 May 1882, *Pringle s.n.* (CAS, F, G, LE, MPU, NY, PENN, PH, US, VT, WU); summit of the Barstow-Cave Springs Road, 29 Apr 1935, *Wolf 6584* (GH, RM, RSA, TEX, WS, WTU). San Diego Co.: Jacumba, 31 May 1903, *Abrams 3655* (BM, DS, E, F, G, GH, K, MO, NEB, NMC, NY, PH, US, Z); Wagon Wash, near Sentenac Canyon, below San Felipe Valley, 20 Apr 1928, *Jepson 12488* (JEPS); San Felipe Valley, 17 May 1925, *Keck & McCully 68* (POM, UC); plains E of Campo, 2 Aug 1898, *Stokes s.n.* (MIN, NEB). San Luis Obispo Co.: between San Juan River and Carriza Plain, 2 Jun 1946, *Hoover 6137* (CAS, DAO, OBI, OKL, RSA); Caliente Range, Padrones Spring Canyon, 3 May 1957, *Twisselmann 3466* (CAS). Santa Barbara Co.: Sisquoc River below Lower Bear Camp, San Rafael Mountains, 30 Jun 1961, *E.R. Blakley 4537* (CAS, RSA, SBBG, UCSB); Hurricane Deck, 20 May 1957, *Hardham 1974* (CAS, RSA); Sierra Madre Mountains, along the lower slopes and ridges of Newsome Canyon, 24 May 1988, *Reveal 6888* (BRY, CAS, MARY, MO, OSC, RSA, WIS). Tulare Co.: 1.5 mi from Lamont Meadow on road to Long Valley, Kern Plateau, 30 May 1967, *Howell & True 42452* (CAS, DAV); Kern River N of Kernville, Sequoia National Forest, 1 May 1935, *Mason 8367* (UC, UTC, WIS, WS, WTU). Ventura Co.: near the Frazier Borax Mine, Mt. Pinos, 12-14 Jun 1908, *Abrams & McGregor 224* (DS, E, G, NY, US); Sandstone Camp, upper Sespe Creek, 9 Jun 1963, *E.R. Blakley 6007* (OKL, RSA, SBBG); Apache Creek, upper Cuyama River Valley, 13 May 1960,

Hardham 5683 (CAS, RSA, UC); Long Grade Road N of Thorn Meadow, 16 Jul 1962, *Pollard s.n.* (CAS, G, ISC, RM); Santa Ynez Mountains, along California Highway 33, 3 mi S of the turnoff to Pine Mountain, 24 May 1988, *Reveal 6873* (BM, BRY, CAS, G, MARY, MO, NY, OSC, RM, RSA, UTC, WIS); Lockwood Valley, 24 Jun 1987, *Reveal & Broome 6569* (ARIZ, CAS, MARY, MO, NY, RSA, TCD, WIS); Quatal Canyon, San Emigdio Range, 7 Jun 1955, *Twisselmann 2109* (CAS, RSA, US). NEVADA. Clark Co.: W slope of McCullough Mountains, 16 mi W of Searchlight, 11 May 1964, *Cronquist 9975* (GH, NY, UTC, WTU); Timber Mountain, 15 mi NW of Searchlight, 24 Apr 1938, *Train 1480* (GH, RENO, UC). Esmeralda Co.: Roosevelt Wells, 24 Jun 1973, *M.J. Williams 73-G-2* (RENO). Lincoln Co.: Mormon Mountains, Jul 1906, *Kennedy & Goodding 83* (MO, NY, UC, US). N end of the Meadow Valley Mountains, 17 May 1983, *Tiehm 7656* (BRY, COLO, DAO, NEB, NY, RSA, UTC); Delamar Valley, 0.8 mi from pole line road to Delamar, 25 May 1980, *Tiehm & Williams 5713* (CAS, MO, NESH, NY, RSA, UTC). Nye Co.: Saddle Road, 1.5 mi N of Schocken Road, Jackass Flat, 23 Apr 1966, *Beatley 3682* (DS, NTS, RENO); NE Bullfrog Hills, 1.5 mi NW of Springdale, 28 Apr 1971, *Beatley & Reveal 12339* (NTS, RENO, RSA); SW of Pinyon Butte, E of Pahute Mesa Road and 1.5 mi S of Airport Road, 8 Jun 1968, *Reveal 1188* (DS, NTS, NY, RENO); S end of the Quinn Canyon Range on N side of Highway 25 at Queen City Summit, 16 May 1982, *Tiehm 6925* (CAS, MO, NY, RM, RSA, UTC). Washoe Co.: on road from Pyramid Lake to Reno, Jun 1927, *Eastwood 14738* (CAS). UTAH. Kane Co.: W face of Johnson Canyon, NE of Kanab, 5 Jun 1969, *Atwood 1789* (BRY, NY); Kanab, 1872, *E.P. Thompson s.n.* (GH); left fork of Last Chance Canyon along the Escalante Road, 10 mi E of Four Mile Bench, 23 May 1975, *Welsh 12721* (BRY, CPH). San Juan Co.: Surprise Valley along Nasja Creek, N side of Navajo Mountain along the Navajo Mountain-Rainbow Bridge Trail, 10 May 1979, *Albee 4459* (UT). Unknown Co.: without location data, 1877, *Palmer 423* (LE, MO, NY, US); without location data, 1874, *Parry 232* (CM, F, G, K, MIN, NY, PH, US). Washington Co.: E slope of Pine Valley Mountains, 3 mi NW of Leeds, 19 May 1973, *Atwood 4963* (BRY, RM); 20 mi SE of Hurricane, 16 May 1965, *Cronquist 10095* (ARIZ, BR, CAS, COLO, DAO, DS, GH, ID, ILL, ISC, MIN, NY, OKL, OSC, RM, RSA, TEX, UC, W, WTU); Diamond Valley, 16 May 1902, *Goodding 817* (G, GH, MO, NEB, NY, RM, US); below Anderson's Ranch, 3 May 1932, *Maguire & Blood 1325* (GH, MO, POM, RM, UTC); East Zion Plateau, 22 May 1973, *R.A. Nelson 10293* (BRY); Lytle Ranch Preserve, Beaverdam Wash, 4 May 1986, *Welsh 23719* (BRY). A total of 651 collections examined.

In the herbarium a distinction has been made between the var. *thurberi* mainly of the Mojave and Sonoran deserts and the var. *macrotheca* restricted to the eastern edge of the inner Coast Ranges and in the southwestern San Joaquin Valley of central California. At the extreme the two are markedly distinct, with the involucres of var. *thurberi* being generally 2-6 mm long and 3-5 mm wide while those of the var. *macrotheca* are mostly (4) 5-8 mm long and 5-8 mm wide. A total of sixteen collections were distinguished as the latter variety, but of that number only twelve are unequivocal. Other than the type cited above, these are as follows:

Fresno Co.: Alcalde, May 1891, *Brandegee s.n.* (UC); W of Coalinga, 13 Jun 1910, *Condit 47* (UC). Kern Co.: 5 mi W of Toad Springs, 22 Jun 1967, *Philbrick s.n.* (SBBG). Kings Co.: Kettleman Hills near Avenal, 1 May 1938, *Hoover 3314* (NY, UC, US). Merced Co.: Piedra Azul Canyon, 4 May 1940, *Hoover 4373* (DS, K, NY, UC, US, UTC); San Benito Co.: Griswold Hills at junction with Griswold Creek and Vallecitos Road, 10 May 1936, *Lyon 796* (CAS, UC); Griswold Hills, 10 May 1936, *G.S. Lyon 796* (CAS); Panoche Hills, 19 Apr 1945, *G.S. Lyon 1686* (CAS). San Luis Obispo Co.: hills between Carriza and Cuyama, 13 Jun 1902, *Eastwood s.n.* (CAS); between San Juan River and Carriza Plain, 2 Jun 1946, *Hoover 6137* (CAS, DAO, OBI, OKL, RSA); Caliente Mountain, 1 Nov 1952, *Hoover 8268* (CAS, OBI); Caliente Range, Padrones Spring Canyon, 3 May 1957, *Twisselmann 3466* (CAS).

Several collections from northern Ventura and extreme northwestern Los Angeles cos. are intermediate in involucral size and tend to break down the distinctiveness of the var. *macrotheca*. Likewise, a few from eastern San Luis Obispo Co. approach the var. *macrotheca* but not to the extent found in the mountains to the south. It is because of the tendency for the two extremes to merge that no taxonomic distinction is now made.

7. Hollisteria S. Wats., Proc. Amer. Acad. Arts 14: 296. 1879. *Eriogonum* Michx. sect. *Hollisteria* (S. Wats.) Roberty & Vautier, Boissiera 10: 92. 1964.—TYPE: *Hollisteria lanata* S. Wats.

Spreading, white-wooly tomentose annual herbs arising from a thin taproot; *leaves* basal and cauline, the basal ones oblanceolate, few to many, mostly erect to spreading, tapering to an indistinct petiole, the cauline ones elliptic to ovate, cuspidate, solitary at each node, sessile or essentially so, gradually reduced above; *flowering stems* few to many arising from the basal rosette, wiry, dichotomous; *branches* numerous and often diffuse, slender, variously tomentose, dichotomously branched throughout; *inflorescences* cymose, open to diffuse, often with the secondaries suppressed, each node bearing a sessile or short-pedicellate flower; *bracts* 3, the lateral two distinct, linear to linear-lanceolate, thinly pubescent, usually several times longer than the obscured third, this linear and typically densely tomentose, situated at the base of the cauline leaf and obscured by it, all awn-tipped; *peduncles* lacking; *involucres* 1, reduced to a series of 3 (4) involucral bracts, linear, pubescent with long curly hairs, awn-tipped; *flowers* solitary, yellowish with a yellowish-green to green midrib, densely tomentose without, glabrous within, the pedicel short and peglike, the tepals 6, petaloid, lanceolate to ovate, mucronate, united only at the base; *stamens* 6, included and attached at the base of the sinsus of the united lobes and alternating with the tepals or if 9 then with the outer 3 opposite the alternating tepals and situated on the fused portion of the floral tube, the filaments glabrous, the anthers oval to oblong, yellow; *achenes* brown to dark black, glabrous, the globose base tapering to a short stout, 3-angled beak, the embryo curved, in abundant endosperm; $n = 21$.

A locally common monospecific genus of the San Joaquin Valley and Coast Ranges of central California, from 50-3200 ft elev; flowering from (Mar) Apr-Jun (Jul).

Hollisteria (William Welles Hollister, 1818-1886, California sheepman and rancher for whom the city of Hollister, San Benito Co., California, was named in 1868) has long been difficult to place in any subfamilial scheme. The genus is similar to *Chorizanthe* and Jones (1908) inadvertently described a specimen of *H. lanata* as a new species of *Chorizanthe*. Dammer (1892) and Gross (1913a) associated *Hollisteria* with *Nemacaulis*, a view sustained by Jaretzky (1925) in his doctoral dissertation on the genera of Polygonaceae. Curran (1885) felt the genus was probably most closely related to *Eriogonum*. At that time she had submerged *Nemacaulis* in *Eriogonum*, and her conclusion was most logical. Stokes (1936) retained *Nemacaulis* in *Eriogonum*, but like Curran did not transfer *Hollisteria*. In 1964, Roberty and Vautier made the combination, *E. lanatum*, thus completing the reduction of the genus. *Hollisteria* has been retained in the major California floras (Jepson 1913, 1925; Abrams 1944; Munz 1959) and was recognized by Shields and Reveal (1988) who associated the taxon with *Eriogonum* and placed it closest to *Nemacaulis*.

The transfer of *Hollisteria* from the Eriogonineae to a taxon that includes such genera as *Chorizanthe* (and in a subtribe that must be called Hollisteriineae) is not suggested without some trepidation. What is emphasized here is the solitary flower subtended by a whorl of awned involucral bracts. In *Nemacaulis* each flower is subtended by a single non-awned involucral bract (not several) and the numerous flowers are congested into clusters. The flower clusters (glomerules) of *Nemacaulis* are concentrated at each node of the axises along the dichotomous branches (Reveal & Ertter 1980) whereas in *Hollisteria* there is only a single flower at each node. The aneuploid chromosome number of $n = 21$ is further evidence of *Hollisteria* being more closely related to *Chorizanthe* where the aneuploid number is known rather than *Eriogonum* where it is currently unknown (Shields & Reveal 1988).

1. **Hollisteria lanata** S. Wats., Proc. Amer. Acad. Arts 12: 296. 1879. *Eriogonum lanatum* (S. Wats.) Roberty & Vautier, Boisseria 10: 96. 1964.–TYPE: Hollister Ranch, Cholame Valley, Monterey Co., California, 8 Jul 1878, *Lemmon s.n.* (holotype: GH!; isotypes: BM, CAS, CM, DS, F, G, GH, ISC, JEPS, K, MIN, MO, NY, P, PH, RSA, UC, US!).
Chorizanthe floccosa M.E. Jones, Contr. W. Bot. 12: 74. 1908.–TYPE: Bakersfield, Kern Co., California, 23 May 1903, *M.E. Jones s.n.* (holotype: POM!; isotype, DS!).

Plants 0.3-0.8 (1) dm high and (0.5) 0.8-3 (5) dm across; *leaves* basal and cauline, the basal ones oblanceolate, (1.5) 2-5 (6) cm long including the winged petiole, (2) 3-7 (9) mm wide, sparsely pubescent on both surfaces, green but soon turning brown, quickly deciduous, the cauline ones elliptic to ovate, 0.5-2.5 (3) cm long, (1) 3-8 mm wide, sparsely to densely tomentose, green to white or tannish, solitary at each node, sessile or nearly so, (0.5) 1-3.5 (4) cm long, 3-8 (10) mm wide; *bracts* 3, the lateral two linear to linear-lanceolate, 2-5 mm long, thinly pubescent, the third one linear, 1-2 (3) mm long, densely tomentose; *involucres* reduced to a series of 3 (4) involucral bracts, linear, 1.5-2 mm long, mucronate, densely pubescent with long curly hairs on the outer surface, glabrous within or at most with only a few scattered hairs; *flowers* solitary, 1.5-2 mm long, yellowish with a yellowish-green to green midribs, densely pubescent without, glabrous within, on short glabrous pedicels up to 1 mm long, the tepals lanceolate to ovate, apically mucronate, united about a quarter of their length, the floral tube campanulate with a minute nectiferous disk at the base of the inner whorl of stamens; *stamens* 6-9, the filaments 0.8-1.2 mm long, the anthers 0.4-0.5 mm long, yellow; *achenes* 1.7-2 mm long; $n = 21$.

Locally rare to common on sandy to gravelly or clayey soils in arid regions in the San Joaquin Valley and on the slopes of the eastern Coast Ranges from Merced and Monterey cos., California, south to the northern edge of the Tehachapi and Transverse ranges from Kern to Santa Barbara cos., from 50-3200 ft elev; flowering from (Mar) Apr-Jun (Jul).

Representative Specimens.–UNITED STATES. CALIFORNIA: Fresno Co.: 9 mi S of Kerman, 27 May 1937, *Hoover 2327* (DS, GH, K, LL, NY, UC, US, UTC, WS); between Arroyo Hondo and Cantua Creek, 1 May 1938, *Hoover 3289* (DS, K, NY, UC, US, UTC, WS); Zapato Chino Creek, 12 Apr 1930, *Jepson 15361* (CAS, JEPS, WS); 3 mi E of Mercy Hot Springs, 12 Jun 1967, *Twisselmann 13362* (CAS, SBBG, RSA). Kern Co.: Maricopa Hills, 15 May 1913, *Eastwood 3267* (BM, CAS, GH, K, NY, US); near Edison, 27 Apr 1937, *Eastwood & Howell 4004* (CAS, MIN, PENN, RSA, UC); 3 mi SE of Bakersfield, 16 Apr 1932, *Ferris & Bacigalupi 8047* (CAS, DS, F, MICH, MONTU, ND, PH, RSA, SMU, UC, US); Oil City near Bakersfield, 22 Apr 1905, *Heller 7741* (DS, E, F, G, GH, ISC, L, MICH, MO, NY, P, PH, RSA, UC, US, WIS); Edison, Greenhorn Mountains, 11 Apr 1937, *Hoover 1818* (DS, K, LL, MICH, NY, UC, US, UTC, WS); along California Highway 58, 1.2 mi W of California Highway 33 near McKittrick, 25 Jun 1978, *Reveal 4771* (CAS, K, MARY, MICH, NY, TEX); 7 mi E of Bakersfield, 21 May 1958, *Rose 58037* (ARIZ, BRY, COLO, DAO, E, G, GB, MIN, RM, RSA, SMU, US, UC); 4 mi E of Bakersfield along California Highway 178, 20 May 1962, *Rose 62030* (BR, CAS, COLO, DAV, DS, ENCB, GB, HSC, MICH, MO, OBI, RSA, TEX); summit of Devil's Water Canyon, Temblor Range, 5 Jul 1971, *Twisselmann 17811* (CAS, NY, OSC, RSA). Kings Co.: Kettleman Hills near Avenal, 1 May 1938, *Hoover 3310* (DS, GH, K, NY, UC, US, UTC, WS). Merced Co.: Los Banos Hills, 28 May 1938, *J.T. Howell 13827* (CAS, ISC, LA, RSA, SD); Ortigalita Canyon, 2 mi NE of Ortigalita Peak, 4 May 1940, *Mason 12266* (ARIZ, BRY, CAN, CAS, DAO, DAV, DS, F, GH, ISC, K, MICH, MIN, MO, NO, NY, ORE, PENN, POM, RM, SBBG, SMU, UC, US, UTC, W, WS, WTU). Monterey Co.: bed of Salinas River at San Miguel, without date, *Norton s.n.* (CAS). San Benito Co.: along California Highway 180, 16.5 mi SE of Panoche, 6 May 1956, *McCaskill 436* (ARIZ, DAV, OSC, UTC, WTU); 5 mi NE of Llanada, Little Panoche Pass, 19 Apr 1938, *Rose 38183* (CM, RM, SD, UC). San Luis Obispo Co.: 2 mi E of La Panza, 8 May 1936, *Eastwood & Howell 2326* (CAS, F, K, MICH, NY, PENN, RSA, US); Recruit Canyon, Temblor Range, 4 Jun 1967, *Hoover 10615* (CAS, ENCB, OBI, OSC); 2 mi E of La Panza, 8 May 1936, *Rose 36257* (GH, L, LE, MO, NY, US, W, WTU). Santa Barbara Co.: Cottonwood Creek Wash, near Bates Canyon Road crossing, S side of Cuyama Canyon, 18 May 1965, *Chandler 2289a* (SBBG, UCSB); along the Ballinger Canyon Road, 0.5 mi E of California Highway 33, 24 May 1988, *Reveal 6893* (BM, BRY, CAS, G, MARY, MEXU, MO, NY, OSC,

RM, RSA, US, UTC, WIS). Tulare Co.: 4.5 mi ENE of Pixley, Pixley Nature Area, 15 May 1968, *J.T. Howell 44474* (CAS). A total of 129 collections were examined.

Hollisteria lanata is a low, annual that spreads on the ground from a thin taproot. The size of the mature plant is determined by the amount of available moisture so that individuals may be a few centimeters across to several decimeters. The flowers are numerous, and especially so on the larger plants, with each one producing an achene that apparently is not widely dispersed. While indirect evidence would point to some bird dispersal, the plant is often local and while common, it is not weedy.

Hardham (1989) found *Hollisteria lanata* to be $n = 21$ or occasionally $n = 22$. My own counts of the species were consistently of the former number (voucher by *Reveal 6893*) and therefore only the one number is accepted here.

8. Lastarriaea Rémy in Gay, Fl. Chil. 5: 289. 1851-1852.–TYPE: *Lastarriaea chilensis* Rémy in Gay.

Prostrate to ascending, thinly pubescent annual herbs with several stems arising from a thin taproot; *leaves* basal or slightly sheathing, the blades linear, hirsute and sometimes rather densely so along the margins, on an indistinct petiole, often with one or more flowers intermixed with leaves; *flowering stems* few or more often numerous and diffuse; *branches* slender and often brittle, readily disarticulating at the nodes especially in age, yellowish-green to green or red, glabrous or more often thinly pubescent with slightly curled glandular hairs, dichotomously branched throughout; *inflorescences* cymose, mostly diffuse, often with the secondaries suppressed, each node bearing a sessile flower; *bracts* 2, lanceolate to narrowly ovate, erect to spreading, the awns uncinate; *peduncles* lacking; *involucres* solitary, reduced to a series of 3 linear to broadly lanceolate involucral bracts, pubescent on the margin, the awns uncinate; *flowers* 1, light green to greenish-white, thinly pubescent without, glabrous within, the pedicels lacking, the tepals 5, coriaceous, lanceolate, acute with a recurved, hooked awn, united about half to three-quarters of their length; *stamens* 3, the filaments short, glabrous, the anthers cream to white, oval; *achenes* brownish, glabrous, the narrow base tapering to a narrow 3-angled beak, the embryo straight, in abundant endosperm.

A small genus of three species on the off-shore islands, along the coast and in the coastal mountains of southwestern California south to central Baja California, then disjunct to the deserts of northern and central Chile, from near sea level to 4600 ft elev; flowering from Sep-Dec or (Feb) Mar-Jun.

Key to the Species

A. Bracts 0.4-2 cm long, lanceolate; involucral bracts linear to lanceolate, 0.3-1 (1.2) cm long, 0.3-1 mm wide; North America.
  B. Bracts narrowly lanceolate, 0.4-1.5 (2) cm long, 0.8-1.5 (2) mm wide, distinctly hirsute, the awns (0.5) 1-2 (2.5) mm long; involucral bracts linear, 0.3-1 (1.2) cm long; California and northern Baja California as far south as the Sierra San Borja. ..... 1. *L. coriacea*
  BB. Bracts lanceolate, 0.5-2 cm long, 1-2 mm wide, spreading pubescent, the awns 0.3-0.6 mm long; involucral bracts lanceolate, 0.15-0.4 cm long; central Baja California. ..... 2. *L. ptilota*
AA. Bracts 0.2-0.6 (1.5) cm long, 0.2-1.5 (3) mm wide, broadly lanceolate to narrowly ovate; involucral bracts broadly lanceolate, 0.2-0.5 (1.5) cm long, 0.8-2 (2.5) mm wide; South America. ..... 3. *L. chilensis*

The taxonomic distinctiveness of *Lastarriaea* (José Victorino Lastarria Santander, 1817-1888, lawyer and founder of the Liberal party in Chile, author and political leader who served as a government minister, ambassador, delegate and senator, and as a member of Chile's su-

preme court) has been greatly debated since Parry (1884) briefly reduced it to synonymy under *Chorizanthe*, proposing a superfluous name *C. lastarriaea* for the one species that he recognized. *Lastarriaea* was originally described by Rémy (1851-1852) who established the name on a South American species he called *L. chilensis*. He was not the first to find the plant or even to recognize that it represented a new genus. A Poeppig collection gathered in Chile from 1827-1829 was annotated with a new name by Kunze while a Guliemin collection made in 1830 was given a different name. In North America, plants had been found by Nuttall in the mid 1830s during his visit to the California coast to which he proposed various herbarium names. Like the others none of Nuttall's names were ever published (Parry 1885).

Bentham (1856) was unable to place *Lastarriaea* within Polygonaceae for some argued (at least on herbarium labels) that the genus might be better placed in the Caryophyllaceae near the genus *Paronychia* than in the Polygonaceae.

Gross (1913a) was the first to suggest that the North American expression might be different from its South American relative. He proposed *Lastarriaea chilensis* subsp. *californica* but did not indicate if his new taxon was native to California or not. Goodman (1934) maintained the North American plants as distinct from those in Chile, calling it *Chorizanthe lastarriaea* var. *californica*. Soon thereafter, Goodman (1943) was able to study Chilean specimens in some detail and came to the opinion the North American plants represented a distinct species which he named *C. coriacea*. Hoover (1966) would eventually transfer that epithet to *Lastarriaea*.

In 1885, Parry received a suite of chorizanthoid specimens from Rudolph A. Philippi, the noted Chilean botanist. Philippi sent him a series of specimens belonging to *Lastarriaea* that he had divided into three species, *L. chilensis*, *L. stricta* and *L. linearis*. Neither of the new species had been described so that when Parry (1886) reversed his view of the previous two years and recognized *Lastarriaea* as a good genus, he validly published the new species before Philippi was able to propose them.

Various interpretations of the involucre and flower of *Lastarriaea* have been put forward. Parry (1884) considered the flower equivalent to the involucre of *Chorizanthe* but failed to explain how a 6-lobed involucre could be identical to a 5-lobed coriaceous flower. Curran (1885) almost immediately challenged this notion. Goodman (1934) maintained *Lastarriaea* in *Chorizanthe* contending that *C. interposita* was a true intermediate stage between the two genera. Since then it has been possible to see more material than the single specimen of *C. interposita* available to Goodman and the perianth of that species is not at all "involucriform." Rather, it is a typical 6-lobed flower similar to the kind found throughout *Chorizanthe*.

In the present treatment the bractlike structures subtending the flowers of *Lastarriaea* are interrepted as involucral bracts. This is a major change but given the placement of the two bracts around the node and three additional ones ("involucral bracts") immediately subtending the flower, this appears not to be unduly foreign considering that a similar sequence is seen in *Hollisteria* and even *Dedeckera*.

In our evaluation of characters prepared in concert with the revision of the annual species of *Chorizanthe* (Reveal & Hardham 1989b), the distinctiveness of *Lastarriaea* from *Chorizanthe* was called into question. *Lastarriaea coriacea* proved not to be that closely related to *C. interposita*, as suggested by Goodman (1934), but in fact to be more similar to *C. brevicornu*. Nonetheless, *Lastarriaea* is maintained as emphasis is placed on the reduction of the involucre to a highly modified series of involucral bracts that resemble cauline leaves or the foliar bracts rather than a true tube as in *Chorizanthe*. In addition, the fundamental differences in the flowers is considered significant. It is not suggested, however, that *Lastarriaea* evolved from something other than *Chorizanthe* nor is it proposed that the genus nec-

essarily came from a pre-*Chorizanthe* ancestor. The taxon is clearly a recently differentiated genus and it certainly evolved from *Chorizanthe*. Its placement in the linear sequence close to *Hollisteria* is because *Lastarriaea* represents a single, isolated branch off *Chorizanthe* while *Hollisteria* is representative of another independent and isolated branch.

1. Lastarriaea coriacea (Goodman) Hoover, Leafl. W. Bot. 10: 342. 1966. *L. chilensis* Rémy in Gay subsp. *californica* H. Gross, Bot. Jahrb. Syst. 49: 435. 1913, non *Chorizanthe californica* (Benth.) A. Gray. *Chorizanthe lastarriaea* C. Parry var. *californica* (H. Gross) Goodman, Ann. Missouri Bot. Gard. 21: 33. 1934. *Chorizanthe coriacea* Goodman, Leafl. W. Bot. 3: 230. 1943. – LECTOTYPE: without location data but perhaps from San Diego, San Diego Co., California, 1882, *Parry s.n.* (lectotype: B!; duplicates of the lectotype: F, G, K, LE, NY, ORE, US!).

Plants 0.2-1.5 dm high and 0.5-3 (5) dm across; *leaves* basal, 0.5-3 cm long, 0.2-0.8 (1) mm wide, linear, hirsute along the margins; *branches* slender and brittle, readily disarticulating, yellowish-green to green or red, pubescent with curled hairs; *bracts* 2, 0.4-1.5 (2) cm long, 0.8-1.5 (2) mm wide, narrowly lanceolate, hirsute, erect or nearly so, the uncinate awns (0.5) 1-2 (2.5) mm long; *involucral bracts* 0.3-1 (1.2) cm long, 0.3-1 mm wide, linear, hirsute, erect, the uncinate awns 0.5-2 mm long; *flowers* 2-3.5 mm long (including the awns), light green to greenish-white, thinly pubescent without, the tepals narrowly lanceolate, awn-tipped, united more than three-quarters of their length; *stamens* 3, the filaments 0.5-1 mm long, the anthers 0.2-0.3 mm long; *achenes* 2.5-3 mm long; $n = 21, 30$ (Hardham 1989).

Infrequent to locally common on sandy to gravelly soils along the coast of California and Baja California Norte, México, from Sonoma Co. south to the El Rosario area, inland into the southern Coast Ranges, the Central Valley and the foothills of the Sierra Nevada from Calavaras Co. south to western Riverside Co., and to the Sierra Borja of central Baja California Norte, from near sea level to 2750 ft elev; flowering from (Feb) Apr-Jun.

Representative Specimens. – MÉXICO. BAJA CALIFORNIA NORTE: Cuesta de la Piedra Parada, Sierra San Borja, 20 Mar 1966, *Moran 12838* (SD, UC); 2 mi NE of Las Escobas, 21 Apr 1975, *Moran 21848* (ASU, CAS, LL, RSA, SD); Arroyo Nueva York, 2 mi SE of the ranch site, 22 Apr 1975, *Moran 21877* (ENCB, MO, RM, SD, UC); 11 km E of Tecate, 7 Jun 1980, *Moran 28700* (ARIZ, SD); 10 mi E of El Rosario, 24 Feb 1973, *Moran & Reveal 20272* (COLO, DAV, SD, UC, US); Arroyo el Socorro, 4 mi from its mouth, 25 Feb 1973, *Moran & Reveal 20279* (MICH, RSA, SD, US); Todos Santos, 7 Apr 1886, *Orcutt s.n.* (MO); San Quintín Bay, Feb 1889, *Palmer 722* (GH, K, MEXU, US, WU); 3 mi E of Uruapan, 21 May 1988, *Reveal 6838* (BM, BRY, CAS, MARY, MEXU, MO, NY, OSC, RM, RSA, UTC, WIS); 7 mi W and S of México Highway 1 at San Quintín, 25 Mar 1988, *Reveal et al. 6760* (CAS, MARY, MO, NY, RM, RSA, US, WIS). UNITED STATES. CALIFORNIA: Calaveras Co.: 1.7 mi SW of Burson, 20 May 1935, *Roseberry 191* (RSA, UC). Contra Costa Co.: Antioch, 1868-1869, *Kellogg & Harford 865* (BM, CAS, G, MO, NY, US). Fresno Co.: Mill Creek Valley, off Wonder Valley Dude Ranch Road, 9 May 1959, *Bacigalupi et al. 7055* (JEPS, RM, UTC, WS); 1 mi SE of Big Panoche Creek near PG&E Line Road, 12 Apr 1936, *Lyon 795* (UC). Imperial Co.: Pigeon Pass in the Box Spring Mountains, 2 May 1967, *Clarke s.n.* (UCR). Kern Co.: Poso Flat, Greenhorn Range, 2-10 Jun 1904, *Hall & Babcock 5022* (DS, UC); near White River, 13 May 1973, *Hardham 19131* (CAS); 8 mi NW of Lockern, 26 Mar 1937, *Johannsen 1406* (RSA, UC); The Crater, Adobe Canyon, 26 Apr 1965, *Twisselmann 10618* (CAS, RSA). Kings Co.: Kettleman City, 1 May 1938, *Hoover 3332* (K, NY, UC, US). Los Angeles Co.: Ballona Harbor, 1 Apr 1901, *Abrams 1218* (DS, MO, POM, Z); upper end of Bulrush Canyon, Santa Catalina Island, 12 May 1965, *Thorne & Everett 34600* (RSA); San Gabriel Wash at Arrow Highway, 26 May 1932, *Wheeler 745* (CPH, DS, LA, MO, ND, OKL, RSA). Madera Co.: 8 mi W of Chowchilla, 13 Apr 1935, *Hoover 525* (K, NY, UC, US). Monterey Co.: 1 mi S of San Lucas, 29 Apr 1957, *J.M. Anderson et al. 436* (COLO, F, GH, NY, OKL, UC); along Del Venturi Road, Fort Hunter Liggett Reservation, 17 Jun 1978, *Broome & Cagle 2168* (CAS, MARY, RSA, WIS); Monterey, 18 Jul 1882, *Pringle s.n.* (E, F, G, LE, MIN, MO, NY, PENN, PH, US, VT, WS, WU); 3 mi NW of McKay, 9 Apr 1938, *R.C. Wilson 530* (DAV, DS, POM, UC, USFS). Orange Co.: along California Highway 74, 0.6 km E of San Juan Guard Station, Santa Ana Mountains, 3 May 1980, *F.M. Roberts 98* (UCSB); Dana Point near Doheney Beach, 16 Jun 1965, *Roos s.n.* (UCSB). Riverside

Co.: E side of Indian Wash, Temescal Canyon, 19 Apr 1986, *Boyd 1697* (HSC, NY, RSA, UCR); near Riverside, 29 May 1904, *H.M. Hall 4964* (DS, PH, RM, UC); Whitewater, 11 May 1903, *M.E. Jones s.n.* (DS, MO, POM, US); 3 mi E of Valle Vista, 23 May 1988, *Reveal 6865* (CAS, MARY, MO, RM, RSA, UTC). San Benito Co.: San Carlos Creek, 13 May 1907, *Jepson 2733* (JEPS). San Bernardino Co.: Barstow, 1 May 1932, *Eastwood s.n.* (CAS); San Bernardino Valley, 2 Jun 1906, *Parish 5777* (L, MIN, ORE, RM); Highland, 9 May 1919, *Spencer 1110* (CAS, GH, NY, POM). San Diego Co.: Point Loma, 7 May 1902, *Brandegee 1623* (G, GH, K, LE, LL, MICH, MIN, NY, POM, UC, US); near San Diego, Mar-Jun 1906, *K. Brandegee s.n.* (DS, MIN, UC, US); 4 mi E of Pala, 11 May 1930, *J.T. Howell 4856a* (CAS). San Joaquin Co.: Lathrop, 17 May 1896, *Congdon s.n.* (MIN). San Luis Obispo Co.: ridge N of Nacimiento River, 3 Jun 1956, *Hardham 849* (CAS); Black Lake Canyon, SE of Oceano, 5 May 1985, *Keil 18755* (OBI, UCR); 1 mi S of San Miguel, 11 May 1937, *Lee 933* (UC). Santa Barbara Co.: bottom of La Cascada, N of Central Valley Road, 2 mi W of Stanton Ranch, Santa Cruz Island, 15 Jun 1969, *M.R. Benedict s.n.* (SBBG); at California Highway 1 and Signature Road N of Lompoc, 15 Jun 1960, *E.R. Blakley 3483* (RSA, SBBG); Cottonwood Canyon Wash at Bates Canyon Road crossing, 18 May 1965, *Chandler 2282* (OKL, SBBG); East Point, Santa Rosa Island, 9 Apr 1930, *Munz & Hoffmann 11734* (GH, POM); N of Fox Canyon and E of Las Positas Road, Santa Barbara, 24 May 1962, *Pollard s.n.* (ARIZ, DS, ENCB, MIN, NO, OKL, RSA, SBBG, SD, TEX, UTC). Santa Cruz Co.: Pear Tree Ranch in lane leading to Isbell Grove, near Santa Cruz, 1887, *C.L. Anderson s.n.* (UC). Sonoma Co.: Petaluma, 1880, *Congdon s.n.* (MIN). Stanislaus Co.: Gobin Ranch, 13 mi E of Waterford, 14 Apr 1935, *Hoover 539* (NY, UC, US). Tulare Co.: 2.5 mi above Springville on North Tulare River, 8 May 1954, *Barneby & Howell 11373* (CAS). Unknown Co.: without location data, 1876, *Parry & Lemmon 371* (BM, F, G, ISC, MIN, NY, US, WIS). Ventura Co.: top of Piru Hill, 2 May 1931, *Hoffmann s.n.* (SBBG); floodplain of the Ventura River N of and near Baldwin Road, 10 Apr 1970, *Pollard s.n.* (DAO, DS, RSA, SBBG). A total of 317 collections examined.

When Gross (1913b) proposed the subsp. *californica* he cited four syntypes. He mentioned a Parry collection without location data that was dated 1882, a Parish collection numbered 819 and dated Apr 1882, a Stokes collection from near San Diego dated Jun 1895 and a collection from Monterey in John Ball's herbarium at E. As a result of the herbarium studies, the following probable syntypes were found:

Monterey Co.: Monterey, 18 Jul 1882, *Pringle s.n.* (E, F, G, LE, MIN, MO, NY, PENN, PH, US, VT, WS, WU). San Bernardino Co.: mesas, San Bernardino, Mar 1881, *Parish & Parish 819* (CM); plains, San Bernardino Valley, Apr 1881, *Parish & Parish 819* (F); mesas, San Bernardino Valley, Apr 1882, *Parish & Parish 819* (BR, LE, MPU, PH, US, WU); mesas, near San Bernardino, May 1882, *Parish & Parish 819* (US); San Bernardino Valley, Apr 1884, *Parish & Parish 819* (UC); San Bernardino Valley, Jun 1884, *Parish & Parish 819* (DS); mesas, near San Bernardino, Apr 1886, *Parish & Parish 819* (MO, NY, US). San Diego Co.: hills near San Diego, Jun 1895, *Stokes s.n.* (B). Unknown Co.: without location data, 1882, *Parry s.n.* (B, F, G, K, LE, NY, ORE, US).

The only collection from Monterey that was in the John Ball Herbarium is a Pringle collection. Although Pringle is not mentioned specifically, there is no question that this was the collection Gross examined. Both the Stokes and Parry collections are at B and these sheets were certainly examined by Gross. As for the Parish material, all of the material numbered 819 is cited. This is presented to indicate the kind of problem one often encounters when working with Parish material in general.

The Parish Herbarium is now at DS and an examination of its holdings show that many of the Parish collections found elsewhere are not represented. It is not known, for example, if the various dates were actual dates the collections were made or the dates the specimens were distributed to other herbaria. At DS, for example, the only specimen numbered 819 was collected in Jun 1884 and none of the remaining six collections found in this study bearing number 819 is at DS. The collection specifically dated Apr 1882 is found mainly in European herbaria (BR, LE, MPU and WU) with only a single sheet now in the United States (PH).

No Parish specimen with the date and number cited by Gross (1913b) was found at B although the others examined by him are present. It is unknown if the sheet was destroyed or is now misplaced. The Parry collection of 1882 is without location data, but two sheets were found which were gathered at San Diego that were dated 1882 (MO, NEB). It is likely

that all of these 1882 collections were taken at San Diego. Because Gross did not specifically mention Pringle, and there is no Parish specimen at B, the Parry collection is selected here as the lectotype and suggested to have been found in San Diego.

In the field, *Lastarriaea coriacea* is a remarkable plant. The stems readily disarticulate so that at maturity a mere touch of the branches will cause the plant to crumble into pieces. Because of the numerous recurved awns on the leaves, bracts, involucral bracts and even the tepals, the individual fragments tend to hang together so that large pieces of the plant may be carried away. This factor has certainly been a significant factor in the widespread distribution of the species and genus.

The unusual chromosome numbers reported by Hardham (1989) indicate that the cytological story of this species has yet to be fully examined.

2. Lastarriaea ptilota Rev., spec. nov. – TYPE: deflated mesa 24 km SE of Bahía Tortugas, east of Bahía Thurloe, Baja California Sur, México, 150 m elev, 7 Mar 1985, *Breedlove 62343* (holotype: MARY!; isotypes: CAS, RSA!).

A *L. coriacea* caulibus glabris cum bracteis lanceolatis, 0.5-2 cm longis et 1-2 mm latis, involucris bractearum lanceolatis, 0.15-0.4 cm longis et 0.3-1 mm latis differt.

Plants 0.3-1 dm high and 0.5-2 dm across; *leaves* basal, 0.5-2 cm long, 0.2-0.8 mm wide, linear, sparsely hirsute along the margins; *branches* slender and brittle, weakly disarticulating, mostly red, glabrous; *bracts* 2, 0.5-2 cm long, 1-2 mm wide, lanceolate, sparsely pubescent mainly along the margins and midrib, spreading, the uncinate awns 0.2-0.6 mm long; *involucral bracts* 0.15-0.4 cm long, 0.3-1 mm wide, lanceolate, sparsely pubescent, mostly spreading, the uncinate awns 0.3-0.6 mm long; *flowers* 2-2.5 (3) mm long (including the awns), green to greenish-white, thinly pubescent without, the tepals lanceolate, awn-tipped, united about half of their length; *stamens* 3, the filaments 0.5-1 mm long, the anthers 0.2 mm long; *achenes* 1.5-2 mm long.

Rare and local on sandy to gravelly soils on Cedros Island and on the western Desierto el Vizcaíno on the adjacent mainland, Baja California, México, 150-500 ft elev; flowering from Mar-Apr.

Specimens Examined. – MÉXICO. BAJA CALIFORNIA NORTE: 0.5 mi W of the village, Cedros Island, 16 Mar 1939, *Haines & Hale s.n.* (LA, UC).

The recognition of the southern extreme as a new species is perhaps daring given the limited material upon which it is based. The aspect of the plant is distinctive and when looking at individuals one notes immediately the recurved or arched bracts that, as the specific name implies, resemble the wings of seabirds in flight when viewed from a great distance. The species is well isolated from the more northern populations of *Lastarriaea coriacea* which does not extend as far south as the Desierto el Vizcaíno.

The morphological features used to distinguish *Lastarriaea ptilota* from *L. coriacea* are not all that significant at first glance. The differences in overall size of parts and the general lack of hairs seems sufficient especially when compared with the features that are used to recognize the Chilean species.

3. Lastarriaea chilensis Rémy in Gay, Fl. Chil. 5: 290. 1851-1852. *Chorizanthe lastarriaea* C. Parry, Proc. Davenport Acad. Nat. Sci. 4: 63. 1884, nom. illeg. superfl. – TYPE: without location data or date, *Gay s.n.* (holotype: P!; isotypes: F, K!).

Lastarriaea stricta Philippi ex C. Parry, Proc. Davenport Acad. Nat. Sci. 5: 36. 1886. – TYPE: Coquimbo, Coquimbo, Chile, Sep 1885, *Philippi s.n.* (holotype: ISC!; isotypes: B, E, ISC, SGO, WU!).

Lastarriaea linearis Philippi ex C. Parry, Proc. Davenport Acad. Nat. Sci. 5: 36. 1886. – TYPE: Coquimbo, Coquimbo, Chile, 18 Sep 1885, *Philippi s.n.* (holotype: ISC!; isotypes: B, SGO!).

Plants 0.2-0.5 (1.2) dm high and 0.5-1 dm across; *leaves* basal and sheathing up the stem, 0.5-1 (3) cm long, 0.2-0.4 mm wide, linear, hirsute along the margins; *branches* slender and brittle, readily disarticulating, yellowish-green to green, sparsely pubescent with curled hairs; *bracts* 2, 0.2-0.6 (1.5) cm long, 0.2-1.5 (3) mm wide, broadly lanceolate to narrowly ovate, sparsely hirsute, erect or nearly so, the uncinate awns 0.2-0.6 mm long; *involucral bracts* 0.2-0.5 (1.5) cm long, (0.5) 0.8-2 (2.5) mm wide, broadly lanceolate to ovate, sparsely hirsute, erect, the uncinate awns 0.2-0.5 mm long; *flowers* 2-3.5 mm long (including the awns), light green to greenish-white, thinly pubescent without, the tepals narrowly lanceolate, awn-tipped, united about half of their length; *stamens* 3, the filaments 0.5-1 mm long, the anthers 0.2 mm long; *achenes* 2.5-3 mm long.

Infrequent to locally common on sandy to gravelly soils along the coast and in the foothills of the mountains of northern and central Chile, from 100-4600 ft elev; flowering from Sep-Dec.

Representative Specimens. – CHILE. ACONCAGUA: Valle de Marga-Marga, SE of Valparaiso, 1931, *Jaffuel & Pirion 3112* (GH). ANTOFAGASTA: 2 km S of Chincolco on road to Fundo "El Sobrante," 9 Nov 1970, *Simon 292* (RSA). COLCHAGUA: 15 km W of Alcones on road to Pichilemu, Oct 1973, *Stebbins 8636* (UC). COQUIMBO: Illapel, Oct 1898, *Geisse s.n.* (SGO, Z); Fray Jorge, 26 Sep 1935, *Muñoz 110* (GH, SGO); Corral de Julio, Exclusion C. Jiles, 7 Nov 1976, *Muñoz-S. 977* (SGO); Vallenar, 13 Oct 1914, *Rose & Rose 19332* (NY, US); Pichidangui, 14 Nov 1976, *Weber & Johnston 966* (COLO); La Serena-Vallenar Road, Cuesta Buenos Aires, 50 km N of La Serena, 1 Nov 1938, *Worth & Morrison 16290* (GH, UC); dunes of Tongoy, 19 Sep 1975, *Zöllner 8277* (MO, NY). SANTIAGO: Santiago, 1855, *Germain s.n.* (BM, G, K); Valle del Clarillo, Nov 1933, *Grandjot s.n.* (MO); Santiago, without date, *Hohenocker 616* (BM, G, GOET, K, LE, TCD); La Obec, 20 Sep 1927, *Montero 478* (F); 8 km W of Tiltil on E slope of Cuesta de la Dormida, 9 Nov 1976, *Weber & Johnston 762* (BRY, COLO, NY, TEX). UNKNOWN: without location data, without date, *Bertero 228* (B, F, G, GH, NY); without location data, without date, *Gillies s.n.* (GH, ISC, NY); Concon, without date, *Poeppig 50* (B, BR, K, LE). VALPARAISO: Quillota, Oct-Nov 1829, *Bertero 959* (F, G, GH, LE, NY); Cuesta de Zapata, between Curacavi and Casablanca, 3 Nov 1948, *Killip & Pisano 39696* (US); dunes of Cochoa near Vina del Mar, 21 Oct 1982, *Zöllner 11356* (MO). A total of 62 collections examined.

Past workers have long associated the North and South American populations of *Lastarriaea* under a single name. Both Gross (1913a) and Goodman (1934) considered the two to be representatives of the same species, but at that time it was felt that the species had been introduced into North America. That was not true, and when Goodman (1943) was finally able to review a large suite of specimens from Chile, he concluded the two were distinct species. As a result of the present review, there is no question that the two are distinct species and each is unique to its own range. The dispersal pattern was from north to south and occurred about the same time during the Pleistocene that the ancestral populations of *Chorizanthe commissuralis* arrived in Chile from western North America. As both of the Chilean species are well adapted for long distance dispersal (as is *Oxytheca dendroidea* which is also in South America; Ertter 1980), it seems reasonable to conclude that birds were the probable agent although migrating mammals cannot be discounted.

ACKNOWLEDGMENTS

I wish to thank the curators and staff of the following herbaria for loans or for arranging access to their collections during visits: A, ARIZ, ASC, ASU, B, BKL, BM, BR, BRY, CAN, CAS, CGE, CHSC, CM, COLO, CPH, CS, DAO, DAV, DS, E, ENCB, F, G, GB, GH, GOET, HSC, ID, IDS, ILL, IND, ISC, JEPS, K, KANS, KSC, L, LL, M, MARY, MICH, MIN, MNA, MO, MONTU, MPU, MSC, ND, NDG, NEB, NESH, NMC, NO, NTS, NY, OBI, OKL, OKLA, ORE, OSC, OXF, P, PENN, PH, POM, RENO, RM, RSA, SBBG, SD, SFSU, TCD, TEX, UC, UCR, UCSB, UNLV, US, USFS, UT, UTC, VT, W, WILLU, WIS, WS, WTU, WU, and Z. Individuals wishing a complete list of herbarium specimens examined may request a copy. Funding for field work has been made possible through a variety of sources. This paper was reviewed by Dr. Edward E. Terrell and Clare B. Hardham. This is Scientific Article A-4937, Contribution 7980, Maryland Agricultural Experiment Station.

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